



Tanta University
Faculty of Engineering
Electrical Power and Machines Engineering Department

Electrical machine 2……. 2014/2015

Sheet (4)

1. A1 φ, 25 kVA, 220/440V, 60Hz transformer gave the following test results.
   Open circuit test (440V side open): 220V, 9.5A, 650W
   Short-circuit test (220V side shorted): 37.5 V, 55 A, 950W
   (a) Derive the approximate equivalent circuit in per-unit values.
   (b) Determine the voltage regulation at full load, 0.8 PF lagging.
   (c) Draw the phasor diagram for condition (b).

2. A1 φ, 200kVA, 2100/210V, 60Hz transformer has the following characteristics. The impedance of the high-voltage winding is 0.25+j1.5Ω with the low-voltage winding short-circuited. The admittance (i.e., inverse of impedance) of the low-voltage winding is 0.025−j0.075(mhos) with the high-voltage winding open-circuited.
   (a) Taking the transformer rating as base, determine the base values of power, voltage, current, and impedance for both the high-voltage and low-voltage sides of the transformer.
   (b) Determine the per-unit value of the equivalent resistance and leakage reactance of the transformer.
   (c) Determine the per-unit value of the excitation current at rated voltage.
   (d) Determine the per-unit value of the total power loss in the transformer at full-load output condition

3. A single-phase transformer has an equivalent leakage reactance of 0.04 per unit. The full-load copper loss is 0.015 per unit and the no-load power loss at rated voltage is 0.01pu. The transformer supplies full-load power at rated voltage and 0.85 lagging power factor.
   (a) Determine the efficiency of the transformer.
   (b) Determine the voltage regulation.

4. A1 φ, 10 kVA, 7500/250 V, 60 Hz transformer has

$$z_{eq} = 0.015 + \mathrm{j}0.06$$
$$R_c = 60\mathrm{pu}$$
$$X_m = 20\mathrm{pu}$$

(a) Determine the equivalent circuit in ohmic values referred to the low-voltage side.
(b) The high-voltage winding is connected to a 7500V supply, and a load of$(-5\ \mathrm{j})$ is connected to the low-voltage side. Determine the load voltage and load current. Determine the voltage regulation

5. A 24-kVA, 2400/240-V distribution transformer is to be connected as an autotransformer. For each possible combination, determine
   (a) The primary winding voltage.
   (b) The secondary winding voltage.
   (c) The ratio of transformation.
   (d) The nominal rating of the autotransformer.

6. Reconnect the windings of a 1φ, 3kVA, 240/120V, 60Hz transformer so that it can supply a load at 330V from a 110V supply.
   (a) Show the connection.
   (b) Determine the maximum kVA the reconnected transformer can deliver.

7. A1φ, 10kVA, 460/120V, 60Hz transformer has an efficiency of 96% when it delivers 9 kW at 0.9 power factor. This transformer is connected as an autotransformer to supply load to a 460V circuit from a 580V source.
   (a) Show the autotransformer connection.
   (b) Determine the maximum kVA the autotransformer can supply to the 460V circuit.
   (c) Determine the efficiency of the autotransformer for full load at 0.9 power factor.